ALL NEW

ARRL CODE KIT

Boost Your Code Speed From 5 to 13 wpm Quickly, Easily, Enjoyably

For the Novice or Technician Radio Amateur Going for the General or Advanced License

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HERE'S WHAT YOU GET

Two Hours of Random Code Groups on Quality Tape Cassettes – Practice at 5, 7½, 10 and 13 Words per Minute

PLUS

Complete, Lively, Fully Illustrated Guide to the Code With Proven Study Tips

$8.00

ARRL Code Kit

By Charles H. Harris, VP2ML

The American Radio Relay League
Newington, CT 06111

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Printed in USA

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Library of Congress Catalog Card Number: 76-55085

First Edition
Fourth Printing

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Foreword

The *ARRL Code Kit* is an important element in the League's continuing efforts to provide the best in Amateur Radio instruction. It provides the means for a Novice or Technician amateur licensee to gain the additional code proficiency needed for the General and Advanced licenses. It helps the amateur broaden his horizons; for, from the hesitant first QSO to the use of highly developed weak-signal techniques, code remains a vital part of Amateur Radio today.

Richard L. Baldwin, W1RU
General Manager

Chapter 1

Your Own Code Kit

Morse code, the International Morse code, the Continental code, cw. The use of long and short sounds to communicate is older than radio; it reaches back to the first land telegraphy stations in the 1800s. And the code has been an integral part of amateur radio since its inception: a part of every amateur's training, as established by international law. The ability to send and receive code is a unique skill that sets amateurs apart from other radio communicators – our own special language, our common bond.

But code is more than mere history. It is an active, vital form of radio communication today. Code is at the heart of many aspects of amateur radio and is the preferred mode in many cases.

DX

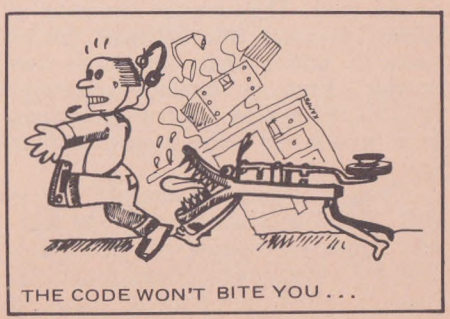
DX, distance communications. To most amateurs, DX means other countries, some of the more than 300 that count toward the coveted DXCC award. Cw and DX go hand in hand. With less crowded bands and increased efficiency, cw affords the opportunity for every amateur to work his share of the rare ones. On phone, high power and large antennas are essential elements to the DX hound; on code, much more modest stations can compete successfully.

Cw is also its own language – an international one toppling otherwise insurmountable barriers to communication. Not every amateur understands English, but through a recognized system of abbreviations every ham can converse in our common language, the Morse code.

Efficiency

Code is still the most efficient means of radio communication. For fast, accurate exchange of information, for getting through interference and noise, for providing vital communications under marginal conditions – nothing beats code.

The use of code to pass formal messages, in emergencies and at other times, has been a basic part of amateur


THE CODE WON'T BITE YOU . . .

Cw puts international communication within the reach of every amateur.

radio since the very beginning. It is from a system of message relays that the *American Radio Relay League* got its name. Even today, a majority of public service, emergency, and health and welfare messages are handled via cw: not for historical reasons, not because of the greater simplicity of cw equipment, but because messages can be handled more quickly and with greater accuracy on cw than on phone.

Cw plays a major role in other aspects of amateur radio communications as well. Weak-signal vhf activities – such as bouncing signals off the ionized trail left by a passing meteor (meteor scatter) or bouncing signals off the moon – strain amateur capabilities to the limit. They require the kind of timing, accuracy and efficient use of available power that only code can provide. Even in satellite communications, the newest amateur technique, code signals are more numerous than voice.

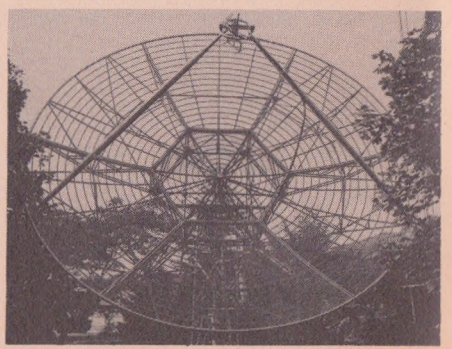
Code is efficient in another way as well: spectrum conservation. The amateur bands are narrow and often very crowded. Interference from other stations is often the limiting factor in communication. But a cw signal occupies a small fraction of the bandwidth of a phone signal. Many more cw stations can squeeze into the same number of kilohertz, reducing interference.

Finally, code is enjoyable. For many amateurs, code is the preferred mode even when voice modes are possible and practical. It *feels* good to communicate by using a special skill which you've developed yourself. From the 100-milliwatt QRP enthusiast to the QRO cw DXer or ragchewer, code and amateur radio are one and the same.

Licensing

Knowledge of the code is a basic requirement of every amateur radio license in the United States and Canada, and some code expertise is required for full use of the hf bands. Amateur licenses in the U.S. are ranked by three levels of code ability: 5, 13, and 20 words per minute (wpm).

Code speed is measured in words per minute, with a standard word five letters long. Each number, figure or punctuation mark counts as two letters. Thus, *WB2CHO* is seven "letters" long or 1.4 words. To determine code speed, count the number of letters (counting two for each number or punctuation mark) and divide by the time in minutes



Even in highly sophisticated moonbounce communications, the old reliable code is the popular mode.

RELATIVE HF PRIVILEGES

CODE SPEED (WPM)		RELATIVE BANDWIDTHS	LICENSE CLASS
	80 METERS		
5		50 kHz	NOVICE, TECHNICIAN
13		360 kHz	GENERAL
		450 kHz	ADVANCED
20		500 kHz	EXTRA
	40 METERS		
5		50 kHz	NOVICE, TECHNICIAN
13		200 kHz	GENERAL
		275 kHz	ADVANCED
20		300 kHz	EXTRA
	20 METERS		
13		250 kHz	GENERAL
		325 kHz	ADVANCED
20		350 kHz	EXTRA
	15 METERS		
5		100 kHz	NOVICE, TECHNICIAN
13		325 kHz	GENERAL
		405 kHz	ADVANCED
20		450 kHz	EXTRA
	10 METERS		
5		100 kHz	NOVICE, TECHNICIAN
13		1700 kHz	GENERAL, ADVANCED, EXTRA

Shaded areas — phone operation

that it takes to send the letters. This is the speed in letters per minute; the speed in words per minute is this number divided by 5 (letters per word). Forty-five letters in 3 minutes is a speed of 3 wpm.

A speed of five words per minute is generally considered equivalent to knowing the letters, while 13 wpm is the start of true code proficiency. Twenty wpm often separates the code men from the boys.

The Novice and Technician licenses carry limited hf cw privileges, commensurate with the 5-wpm code requirement. The General and Advanced licenses reward the 13-wpm cw operator with much more hf spectrum, including

voice privileges on those bands. And the Extra license, with its 20-wpm requirement, gives full usage of every amateur band, including some coveted DX band segments on both phone and cw.

In Canada, 10-wpm code skill leads to the Amateur radio operator's license. Fifteen wpm is necessary for the Advanced Amateur license, which gives full use of the hf amateur bands.

Examinations

No longer does every amateur code examination consist of both a receiving and a sending test at the required speed. In Canada, the receive-only tests last for three minutes and passing is 100 percent, no mistakes. In the U.S., only the Novice class license requires both sending and receiving.

The receiving test, normally given first, consists of plain text sent for five minutes. The sending test is also plain text, again for five minutes. At the discretion of the voluntary examiner, the applicant will be evaluated in one of two ways. Under the "perfect copy" criterion, he is required to copy perfectly one minute out of five, or 25 consecutive characters at 5 wpm. Alternatively, he may be tested under the "comprehension" criterion of answering correctly seven out of 10 fill-in-the-blank questions based on the content of the text, usually a sample amateur QSO. Often, many of these questions can be answered even though the applicant missed a significant portion of the text. The comprehension-style test emphasizes understanding, testing the applicant's skills as they will be used on the air.

The examinations for the Novice license are given by local amateurs, either by request or in connection with a local license class. All other amateur exams, Technician through Extra Class, are given by FCC personnel. They do not require a sending test and are limited to only the comprehension-style receiving test. These exams are given in FCC Field Offices throughout the country. The ARRL *License Manual* gives complete details.

Sample Comprehensive-Style Code Texts

W6EJJ DE W7PGY RR BT TNX FOR CALL BRET
RIG IS COLLINS ES ANT IS LONG WIRE BT
WX HR IS WARM AND SUNNY
NAME HR IS ROY ROY BT
QTH IS MARS CITY PA MARS CITY PA BT
UR RST RST IS 569 569 BT
HW? W6EJJ DE W7PGY KN

KL7YFT DE WD2VDN RR BT TNS FOR CALL BRET BT
UR RST RST IS 459 459 BT
QTH IS PARK CITY TX PARK CITY TX BT
NAME HR IS BOB BOB BT
RIG IS KENWOOD ES ANT IS INVERTED V BT
WX HR IS COLD AND SNOWY
HW? KL7YFT DE WD2VDN KN

W2FJT DE W8CNP RR BT TNX FOR CALL RENE
WX HR IS WARM AND WINDY
RIG IS YAESU ES ANT IS DIPOLE BT
QTH IS CLARK ME CLARK ME BT
UR RST RST IS 599 599 BT
NAME HR IS ROB ROB BT
HW? W2FJT DE W8CNP KN

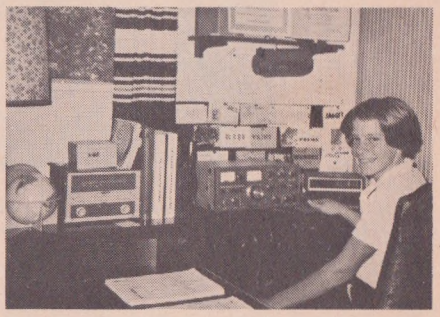
For sample questions based on these QSOs, turn to page 27

Chapter 2

Assembling a Code Technique

Increasing your code speed is remarkably easy if you *learn* the code properly. It's like learning how to type. If you begin with proper touch typing, increasing your speed and accuracy will be a simple matter of practice. If you begin with the hunt-and-peck method, you may start typing more quickly, but true typing proficiency will be impossible without "unlearning" the hunt-and-peck habit.

How do you *learn* the code to make improving code skills easy? A few simple suggestions can help you reduce the effort needed to *increase* your code speed in the future.



Start on the right foot learning the code and you're off and running toward higher licenses, like KA6EWF.

Learn by Listening

You will notice that the code is not written down anywhere in this publication. Learning the code by diagrams or by any other method than hearing the actual sound will catch up with you before 13 wpm. You should learn the code by *listening* – to a tape, record or instuctor sending cw – where the code character is followed by the letter: "didah, a."

You will then learn to associate the sound of the character with that letter directly, skipping additional translation steps. If, for instance, you learn that "a" is a dot followed by a dash, then when you hear "didah," you will translate that into a dot followed by a dash, and further translate that into "a." This double translation will limit your code speed to about 10-12 wpm. For faster speeds you must "unlearn" the double translation step and relearn the direct translation of sound to letter. By starting with sound-letter association,

The ideal start to your amateur career, from learning the code the easy way to the best explanation of theory and operating: *Tune in the World with Ham Radio.*

you will skip this difficult re-education process and avoid the 10-wpm "plateau" in code proficiency.

Start at High Speed

Another hint to learning the code properly the first time is to listen to the characters at high speed, such as 15-16 wpm. The spacing between the characters can be increased to slow the speed down to about 5 wpm. Sending the characters at high speed makes it impossible to count dots and dashes, and forces you to learn the code by sound only. Listen to W1AW slow-speed practice for an example.

Write, Don't Print

Finally, if your handwriting is legible, start *writing* the code as you learn, rather than *printing* it. Why learn to print all over again while trying to learn the code at the same time? In any case, soon you will need to copy code faster than you can print. Then you will have to unlearn printing and start learning to write as you copy. It's a lot easier to start off writing.

The cassette tape in the ARRL *Tune in the World with Ham Radio* package is a *teaching* tape, patterned after these recommendations. It contains some code practice, but its primary function is to *teach* the code in a way that will make improving your code skills easy. If you start off on the right foot in learning the code, the steps toward true code proficiency will be easy.

Chapter 3

Receiving: The Proper Way

There are no secrets to increasing your code speed – no mystery, no magic formulas passed from generation to generation of amateurs. The only method of increasing your code proficiency can be summed up in a single word: practice. As the coach tells his players, the key to success is practice.

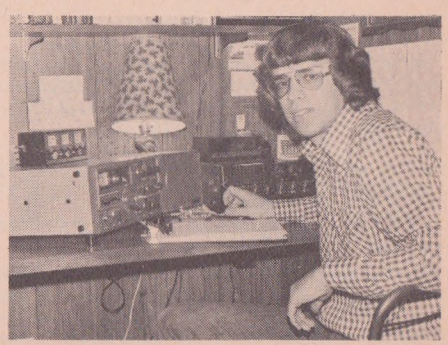
Your success at code is dependent on your dedication. Gaining code proficiency is not really difficult, but it does take some time and a conscientious program of practice. Both come from dedication. If you sincerely *want* to reach 13 wpm, you will. Here are a few suggestions to help you channel your dedication in the most productive ways.

Your code speed will improve just as rapidly with a few minutes of effort every day as it will with hours and hours of practice. About 15-20 minutes once (or at most twice) a day are plenty. More than this and an enjoyable task becomes a chore.

The best use of your dedication to higher code proficiency is to establish a regular schedule of daily practice – and stick to it. A few minutes every day will produce better results more quickly than a few hours of study one day each week. So set aside a definite time every day, and stick to that schedule until you have reached the desired skill. Fixing this practice time around a regular event, such as just before a meal, is an easy way to build code practice into your daily routine.

In working on your code speed, you are actually trying to perfect what scientists call a conditioned reflex. Just as dogs can be made to salivate at the sound of a bell, so can your hand be trained to write "a" at the sound of didah. You probably have a number of conditioned reflexes already, such as reaching for the alarm clock as it starts to ring. Reflexes appear when the action is repetitively associated with the sound. Another name for this conditioned reflex is habit.

As you acquire the habit of code, you will soon stop trying to think about what you are hearing. Your hand will



KAØDOO increases his code speed through contesting.

WB2TNC conducts the code-practice portion of the Novice license class.

automatically write the letter, while your brain can be busy elsewhere. How can you acquire this beneficial habit? The same way you pick up other habits – by repeating the actions again and again. Every time you hear a sound, make your hand write the letter. Try to ignore the fact that the sounds are composed of dots and dashes, and think only of the letter when you hear the sound. Combine this with regular practice, and you will pick up the code habit in no time!

As you write the code, don't read your written copy. A common problem in working with the code is trying to decipher what you have written. As you start to read, your attention wanders, and you begin to miss letters. Just concentrate on writing what you hear and read it later. Copy with your eyes shut, or the paper covered, if you have trouble keeping your eyes off the copy.

Also, whenever you miss a letter, make some kind of mark – a small dash, anything to indicate that you missed a letter. It's much easier to figure out TRU–KS than BUES (buses).

Types of Practice

You've made your decision: You are going to reach 13-wpm code proficiency. You are willing to set aside 20 minutes a day for as long as it takes. Your pencils are sharpened, your paper ready. How do you start?

There are lots of different ways to practice listening to the code, each with its own advantages and disadvantages.

On the Air

Actually getting on the air to make cw contacts has the advantage of being the most enjoyable way to work on your code. As you talk to hams throughout the world, you reap the benefits of your improving skills as you practice. And making contacts ensures that you pay close attention to the code; you wouldn't want to miss anything in the middle of a conversation. Finally, you are developing the skills in the exact way you will be exercising them: in amateur contacts. Both the FCC comprehension code test and your future amateur contacts will be in this format.

W1AW Code Practice

W1AW transmits code practice according to the following schedule. Approximate frequencies are 1.835, 3.58, 7.08, 14.08, 21.08, 28.08, 50.08 and 147.555 MHz. For practice purposes, the order of words in each line may be reversed during the 5- to 15-wpm transmissions. Each tape carries checking references.

5-7-1/2-10-13-15 wpm	MWF: 0200, 1300, 2300; TTH: 2000; S: 2000; Sn: 0200, 2000 UTC
35-30-25-20-15-13-10 wpm	MWF: 2000; TTH: 0200, 1300, 2300; S: 0200, 2300; Sn: 2300 UTC

These are times UTC when the U.S. is on Daylight Savings Time. In the other half of the year add one hour.

Additionally, 18-wpm cw bulletins are transmitted on the above frequencies daily at 0000, 0300 and 2100 UTC. These can be used as another source of code practice.

W1AW Qualifying Runs and Frequency Measuring Tests may preempt regular code practice transmissions. See the W1AW Schedule published bi-annually in *QST* or send an s.a.s.e. to ARRL, Newington, CT 06111, for latest schedules with recent updates, changes and local-time conversions.

W1AW Qualifying Runs 10-35 wpm for 1982

W1AW transmits on 3580, 7080, 14080, 21080, 28080, 50080 and 147.555 kHz.

A sample listing of W1AW Code Qualifying runs is printed below. The latest schedule appears in *QST* twice yearly or may be obtained for an s.a.s.e. by writing ARRL, Newington, CT 06111.

UTC			EDT	CDT	PDT
July 8	0200Z	July 7	10 P.M.	9 P.M.	7 P.M.
July 21	2300Z	July 21	7 P.M.	6 P.M.	4 P.M.

West Coast Qualifying Runs. Runs by W6OWP (prime), W6ZRJ (alternate), will be transmitted simultaneously on approximately 3590/7090 kHz at 0400Z May 1, June 4, July 5, Aug. 7, Sept. 4, and Oct. 1. (Please note that 0400Z represents 9 P.M. PDT the *"evening before."*)

Qualifying Run Procedure. Note the date of the run, the station and frequency you copied. Underline one minute of your highest speed. Count letters, numbers, punctuation marks and spaces between words as *"character units."* 10 wpm = 60 units; 15 wpm = 90 units; 20 wpm = 120 units; 25 wpm = 150 units; 30 wpm = 180 units; 35 wpm = 210 units; 40 wpm = 240 units. Include a statement that the run was copied without aid (you may type, however), and whether you're applying for the initial certificate or endorsements. (Awards are given starting with 10 wpm, and endorsement stickers are issued for advances in speed through 40 wpm.) Furnish your complete name, call (if any), and mailing address. Please include a stamped addressed return envelope for your award (10 × 4-1/2 in. for certificate, or smaller for sticker). Send to **ARRL, 225 Main St., Newington, CT 06111.**

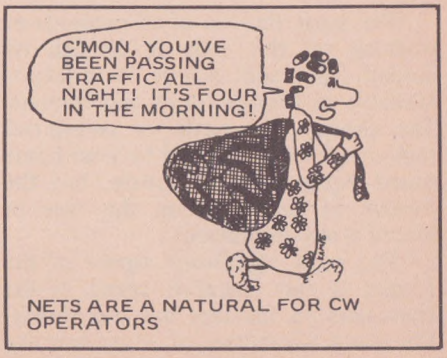
The drawbacks to this method are its irregular nature, the greater difficulty of copying through noise and interference and (possibly) poor sending by the other operator. If the copy is poor, the sending irregular or the ratio (the relationship between the length of the dot and the dash) strange, the practice becomes much more difficult. Finally, making contacts on a regular schedule is not always possible, and some of the benefits of regular practice may be lost.

Cw traffic nets provide a solution for this final problem, as they do meet on a regular schedule every day. Also, you are performing a public service while working on your code. More details on traffic nets and message handling can be obtained from the League in free booklets: *Operating an Amateur Radio Station, The Public Service Communications Manual,* and the *Net Directory.* The *ARRL Ham Radio Operating Guide* also covers cw traffic nets.

Another excellent source of on-the-air code practice, with a large element of fun mixed in, is a cw contest. The stereotyped exchange, the rapid contacts and the thrill of making contact after contact in a short time make cw contesting a great way to build your code proficiency while building your DXCC and WAS totals, and while simply having a good time! Complete details on contest operation can be found in the *ARRL Ham Radio Operating Guide,* while the monthly "Operating Events" in *QST* lists all important contests.

W1AW

Probably a majority of today's amateurs owe their licenses to code practice from W1AW, the ARRL headquarters station in Newington, CT. The daily schedule of code practice at a variety of speeds is the most popular of all



NETS ARE A NATURAL FOR CW OPERATORS

Cw contests are a natural for KA9CHM, third in the nation in the 1981 Novice Roundup!

methods of building code skills. Working with W1AW has the advantage of forcing the listener into a regular pattern on a daily basis, provides perfectly formed characters and letter spacing, and even provides tangible evidence of your efforts, through the code-proficiency program.

The disadvantages? The copy on W1AW is dependent on the vagaries of propagation, and copying through the interference and noise can require more effort than the task of improving your code skills. But W1AW is hard to beat for increasing your code speed, as literally thousands of amateurs can attest.

Tapes and Records

The most flexible of all methods of working on the code is through recorded tapes and records. A variety is available in various forms and formats. The choice of cassette or reel-to reel tape or record is dictated by your home sound equipment, of course, but the *format* of the code on the tape or record is also important.

The most significant aspect of the format is fast character speed. If the characters on the tape are sent slowly, the many advantages of sound-learning are lost, and your code speed may actually decrease. Also, code groups are much more difficult to memorize and anticipate than plain-text tapes. The ideal tape contains random code groups, including numbers and punctuation, sent with 16-wpm characters, as do the tapes enclosed in this package.

Working Together

Another way of practicing code is to get together with a friend who has the same goal and send to one another. Once you have learned the letters, you can send anything at all back and forth. If you're practicing on the air (with your license) such as on 10-meter nets, remember to identify every 10 minutes. Good sources of on-the-air practice material are the books you are using to learn theory!

Working with another amateur adds to the code practice the benefits of flexibility and the enjoyment of working together. By taking care to send properly, with fast characters and longer spacing, the practice can be as beneficial as other forms of on-the-air practice. Also, your fellow amateur can help you pinpoint sending problems (see chapter 4).

Classes

A final method of ensuring regular code practice is through code classes. Many local radio clubs and other organizations hold classes for General and higher grades of amateur license, and many of these include code practice sessions along with the theory work. The classes guide you into a regular schedule of practice, but they are not enough by themselves; the student will still need additional practice on his own using one of the above methods.

How Fast?

What is the best speed to listen to as you strive to increase your code proficiency? Listening to a speed at which you can copy 100 percent benefits nothing except your ego. The real im-

provement in code speed occurs when you strain to get characters at well above your perfect copy level.

If you can copy 5 wpm without error, start listening to the tapes or W1AW at 7.5 wpm. You will get only some of what is sent, but you will be improving your code much more rapidly. Also spend some time at a speed where you can only get about 25 percent of the letters (10 wpm in this case).

As your speed improves, continue to practice just above your perfect copy level, and spend some time well above that. As you work toward 13 wpm, for example, the daily 10-15 wpm W1AW practice is perfect: a few minutes at 10 wpm to prove you really can copy code, about 10 minutes at 13 wpm for the test, and some more time at 15 wpm, to make you push a little.

Plateaus of Learning

Few code aficionados have not heard of the "10-wpm plateau," and other so-called barriers to code proficiency. These are particular levels where your code speed seems to remain about the same, or even decrease, no matter how much you practice.

These "barriers" are not imaginary, but they are avoidable. The 10-wpm plateau, as indicated in chapter 2, comes from approaching the limit on the double translation method. Above about 10 wpm you no longer have time to translate the sound into the dots and dashes, then the dots and dashes into the letter.

If you learned the code visually, using the dots and dashes, you may therefore run into this leveling off of code skills – at least for a while. The only way around this problem (outside of learning the code properly to begin with) is practice and more practice. You have to unlearn the dots and dashes, and build up a new habit or reflex going directly from the sound to the letter. No wonder it is as difficult (or as easy!) as learning the code in the first place; that is exactly what you are doing, all over again.

The best solution is to try to copy at well above your perfect copy speed, as this helps you ignore the dots and dashes and work only on the sound. In fact, listening to code at about 20 wpm is a good method of crossing this "plateau." Of course, you won't be able to copy everything, or even more than a few letters, but by writing down these few letters as you hear them, you are developing that important reflex and learning the single-translation method of copy.

The only way through this "barrier," then, is practice – concentrating on the sound of the letter itself and not on the dits and dahs which make up the letter. Copying at 15 wpm and higher helps.

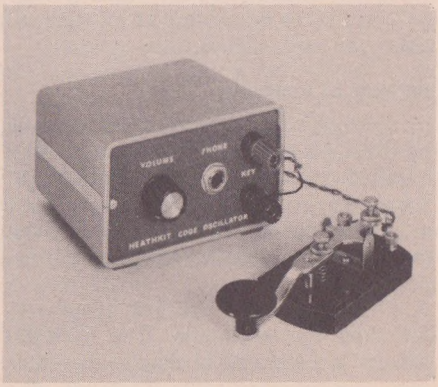
Sending: The Flip Side

Your ability to communicate in Morse code is determined by your ability to send as well as receive. For this reason, every code examination includes a sending as well as a receiving test. Sending is easier to learn than receiving, but, like anything else, sending properly takes practice.

As you can quickly tell by tuning across the cw subbands, good sending (known as a "good fist") is a pleasure to copy and actually gets through interference and noise more effectively than sloppy sending. If you can receive code, you can send it; but sending it well, so that others can easily copy you, takes practice.

To send, you will need a key of some sort and a code practice oscillator (CPO). For the do-it-yourselfers, a common circuit is shown on page 17 of this book. Ready-made CPOs and straight keys can often be found at radio parts stores.

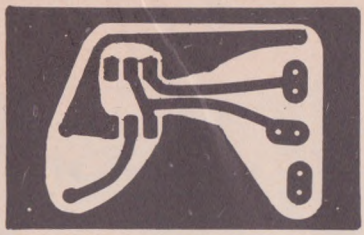
Are you interested in becoming really proficient with the code? Learn to send using the hand you do not write with. This frees your writing hand for logging, copying messages, etc., while sending. It is no harder to learn to send with the "other" hand than with your writing hand, and you'll appreciate this around 20 wpm or in your first cw contest!



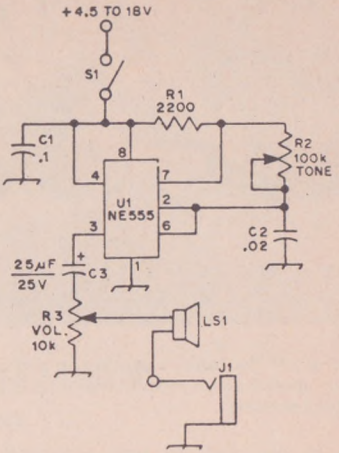
A CPO and a straight key are essential ingredients in sending practice.

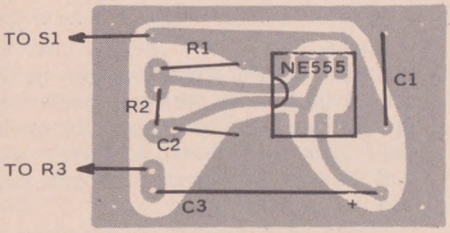
Sending

To send the code, think of the sound of the letter you wish to send and move the key to produce that sound. Since you didn't learn the code with dots and dashes, you can't visualize the letters in this form to send it, but the sound method works well here also. To check what your sending sounds like to the other guy, tape record a few minutes worth of your sending. Play this tape



FOIL SIDE





PARTS SIDE

Printed-circuit boards are available from Circuit Board Specialists, P. O. Box 969, Pueblo, CO 81002.

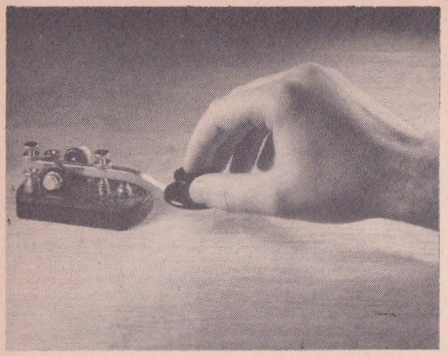
C1 — 0.1-μF ceramic disc capacitor.
C2 — .02-μF ceramic disc capacitor.
C3 — 25-μF at 25-V dc electrolytic capacitor.
J1 — 1/4-inch open-circuit phone jack.
LS1 — Any convenient 8-ohm loudspeaker.
R1 — 2.2-kΩ composition 1/4-watt resistor.
R2 — 100-kΩ composition 1/2-watt linear taper potentiometer (may be replaced by suitable fixed-value resistor).
R3 — 10-kΩ composition 1/2-watt audio taper potentiometer.
S1 — SPST on-off switch.
U1 — NE555 integrated circuit.

back the next day and try to copy it. Any sending problems will be very apparent. If you can't copy your own sending, no one else will be able to.

Sending Problems

What do we mean by sending problems? The most common are improper spacing and poor ratio. The ideal ratio has the long sounds three times the length of the short sounds. In proper spacing, the pause between parts of a given character should be about as long as a "dit," the spacing between letters about as long as a dah, and the spacing between words about two dahs (plus the space between them) in length. These letter and word spacings do not hold at speeds below 13 wpm because the characters themselves should be sent at a much higher speed with artifically long spacing to slow down the effective speed.

Traditional sending problems include complete lack of word spacing (causing the received copy to run together) and



The wrist off the table, a gentle grip and a smooth up-and-down motion make for clean, effortless sending.

Iambic keyers can be recognized by their double paddle.

irregular spacing within a given character, so that "c" is copied as "nn." Just listening to your own sending will identify these errors quickly, before they become ingrained as part of your code habit.

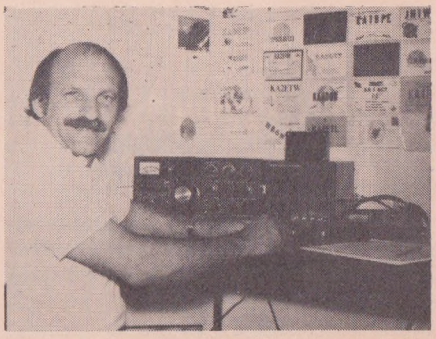
W1AW code practice provides a unique way to work on your sending. Several times each month code practice sessions based on *QST* text are sent from the hq. station. *QST* lists the scheduled times and speeds in each issue. You can listen to the practice as you send the same text with your CPO, in step with W1AW. By trying to match your sending to W1AW, you'll be producing perfect code in no time.

Using a Straight Key

A key is essentially a means of making and breaking a connection easily. The straight key and bug do this mechanically; electronic keyers use relays or transistors to control the current flow.

Mount the key firmly to the operating table, or to a piece of thin wood or metal, so that it can be operated without bouncing around the table. Adjust the contacts until the handle moves about 1/16" when depressed. Adjust the side tension knobs (if any) to reduce side-to-side sway. Finally, adjust the spring tension to a comfortable feel. If you are unsure what is comfortable, start with a pretty stiff feel and loosen up just enough to prevent chopping your characters short. A slightly stiff feel reduces the chance of sloppy, run-together characters.

Once the key itself is adjusted, adjust yourself. Good posture and arm motion help make sending less tiring and more enjoyable. You should rest your elbow on the table, with the elbow supporting the lower arm. The wrist should be held lightly off the table. Place your hand gently on the handle of the key, about as shown. The actual grip is of little importance, as long as it is



Even a modest station provides worldwide communications via cw, as KA6EVS shows.

comfortable. Now send from the wrist, not the fingers. Gently flex the wrist and presto! – code.

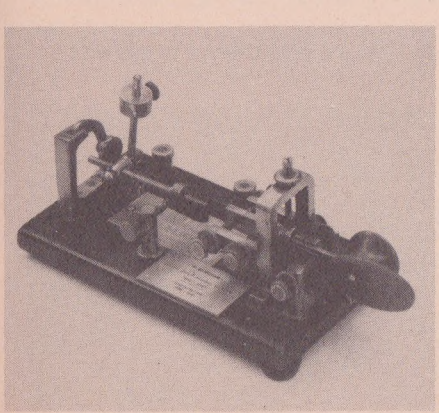
Sending Aids

If you are serious about your code, eventually you will want to switch from the straight key to some form of automatic sending device, such as a "bug" or keyer. If you are content with the 13-wpm level, trying to learn how to send with a keyer is a waste of time; below that speed it's easier to send good code with a straight key.

As you continue to progress and increase your code speed, particularly if your sending begins to get a little sloppy around 15 wpm, you should consider the use of an electronic keyer. A keyer automatically makes a string of dits as the paddle is pushed in one direction, and a string of dahs when held in the other direction. To send a character, the paddle is pushed gently back and forth to produce the proper combination of sounds.

The hand motions involved in using a keyer are completely different from those with a straight key. The gentle, side-to-side motion sharply contrasts with the more rapid, up-and-down motion of the straight key. This makes learning to send with a keyer just like learning to send all over again. The only advantage the keyer provides at the beginning is proper character ratio, which is determined automatically in most keyers.

You should master the keyer (or the straight key, for that matter) before you use it on the air. The rapid string of electronically generated dits signifying an error in sending is commonplace among those learning to use the keyer on the air. It is discourteous to the poor ham at the other end who has to listen to your fumblings.



Once master of the airwaves, the bug has moved over to electronic keyers.

Keyers

There are two basic types of electronic keyers: iambic and noniambic. Iambic keyers always have two paddles and produce a didahdidahdidah pattern when squeezed, that is, when both paddles are activated simultaneously. With an iambic keyer, a "c" can be produced with a simple squeeze. Noniambic keyers usually have a single paddle. Those with a double paddle usually produce strings of dahs when squeezed.

For speed, accuracy and ease of use, the iambic type is superior. If you have never used a keyer, it is best to begin on the iambic. Switching over from one type of keyer to the other is almost as difficult as learning to send with a keyer in the first place, so stick to one type or the other.

Many keyers have special features which may prove useful. Self-completing dits and dahs are just about standard and dit memory is also popular. With dit memory, you can press the dit paddle while the keyer is sending a dah, and the keyer will automatically insert the dit, after the proper space, at the end of the dah!

Memory keyers are very popular, especially with contesters who must send the same information over and over again. A memory keyer can be "programmed" to send any short message in code, at the touch of a button.

You can have the keyer send CQ while you're looking around the shack for a pencil.

Bugs

Amateurs are often trying to get bugs out of their equipment, but a certain kind of bug is useful in sending code. A bug is an early, mechanical answer to the electronic keyer. It automatically makes dits when the paddle is held in one direction. Dahs must be made individually. Because of the expense, necessary adjustments and maintainance, and the detectable "swing" of the bug, it is rarely used today. The electronic keyer does everything a bug can do and more, with less effort.

Keyboards

The ultimate in automatic cw sending is the electronic keyboard. The device looks like a typewriter keyboard and automatically sends the letter as the key is pressed. Its expense and the need to know how to type limits its use considerably. It is used primarily by very high-speed operators, in the 50-70 wpm range.

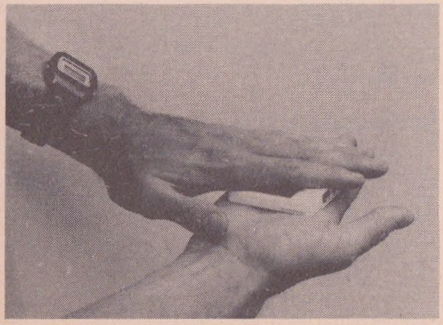
Chapter 5

Using Your Cassettes

The main reason you purchased this package was the two code cassettes enclosed. We have already discussed the advantages of cassettes in chapter 3; now let's get down to specifics on how to get the most out of them.

The code cassettes in this package consist of a half hour of code practice at each of four speeds: 5, 7.5, 10 and 13 wpm. These speeds have been selected to provide a gradual increase in code speed from the level of the Technician or Novice to that of General and Advanced – and a little beyond, toward the Extra.

The use of random letters and other characters on these tapes makes them very difficult to memorize or anticipate. This allows the student sufficient practice to gain some proficiency at each of the four levels. If you can copy random characters perfectly at a given speed, your ability with plain text should be 20-25 percent higher.



A gentle slap before each use loosens the tape and prolongs cassette life.

The tapes are made from the same machine which generates code practice for the ARRL headquarters station, W1AW. Thus, the characters on the 5-, 7.5- and 10-wpm tapes are sent at approximately 16 wpm, with increased spacing to slow the effective speed. At 13 wpm, the spacing reverts to normal, with the space between letters equal to the length of one dah, and the space between words about two dahs (plus the space between them) in length.

This makes for one rather disconcerting effect: The code speed appears to slow down from 10 to 13 wpm! This is because the speed at which the characters themselves are sent is indeed reduced, from 16 to 13 wpm, giving the impression of slower code. Since the spaces between the letters have been greatly reduced, however, the speed is indeed greater. This change to normal spacing at 13 wpm helps prepare the student for the form of the FCC exam-

Use of a pencil to tighten the tape before listening reduces tape jams.

ination and for typical on-the-air contacts at that speed.

Using the Cassettes

To use the ARRL code practice cassettes, you will need a cassette playback machine or a recorder. If you do not own one, you may find it worthwhile to obtain a recorder, as it will be useful in other aspects of radio. Aside from its value in taping your own sending (see chapter 4), it can be used to record W1AW for additional practice and to tape contacts, class notes and more.

Cassette players are available from a variety of sources, from electronics supply houses to discount stores, at prices of $20 and up. Even the most inexpensive machines are adequate for listening to code practice: high fidelity is not essential here.

Now to Listen

You have selected a given time each day that you will devote to code practice, say about 20 minutes before dinner. Pick a location where you won't be disturbed by the telephone, family cat, etc. Make yourself comfortable, in a relaxed position so that you can write without straining. Now relax yourself: a few deep breaths, a general loosening of those tense muscles in the back and chest, and you're ready.

Pick your speed as described in chapter 3: a few minutes of your perfect copy speed to build your confidence and further relax you, then 10-15 minutes at the next highest speed, and finally a few minutes well above your perfect copy speed to force you to strain a little. This last effort helps you recognize the characters at a significantly higher speed.

Concentrate on the code, not on how well you are copying; you can look at the copy after you are finished. While the code is on, keep your attention on it and it alone. If your attention is wandering, stop, relax and try again. It does little good to simply sit and listen to the code, without even trying to concentrate. Lack of concentration can lead to little or no improvement in code proficiency. Stick to it!

To vary the practice, start the cassette in a slightly different place each session. You don't want to listen to the entire half hour all at once, in any case. Run the tape through a few feet to a spot a little further ahead than last time, and begin there. It will make anticipating the content of the tape that much more difficult.

For even more variety, try reversing the order of the speeds every few days: start with the highest speed and work down to your perfect copy speed. You may find that you prefer this method more than working up in speed. If so, don't hesitate to use it most of the time and switch back to the other method for variety.

In the Car

Many people work on their code in the automobile on the way to work. This is a fixed time every day, and time otherwise spent threading through typical rush-hour traffic. However, a couple of precautions are in order. Your concentration on the code will not be perfect; after all, you do have to watch the road and the traffic once in a while.

Also, you are trying to develop the reflex of *writing* the code as you hear it, and it is impossible to write as you are fighting traffic.

The best way around this is to use the highest possible speed and concentrate on catching letters as they go by. Make no effort for perfect copy; just try to *recognize* the letters and think them to yourself (or say them out loud if your car pool can stand it!). If you have to concentrate on the road for a while, nothing is lost. Finally, code practice on the way to work, when you are reasonably fresh, may be more advantageous than on the way home, after a day at the office. Try it; you may like it!

Care of Cassettes

Any precision-engineered item requires some care to work properly and code cassettes are no exception. If the cassettes are properly stored and handled, they will outlast the tape recorder!

Heat, dust and magnetic fields are poison to recording tape. Heat warps the cassette itself (causing jamming), softens the tape (allowing stretching) and increases random noise. One of the hottest places to store tape is on the dashboard or in the glove compartment of the car. Take them inside to school or work with you. You wouldn't leave your pet in the car all day; don't leave the cassettes there either.

Dust is another enemy of cassettes. These tapes are carefully engineered with very close tolerances. Even a small amount of dust within the cassette can cause binding and jamming, possibly stretching and even breaking the tape. Store the cassettes in the container supplied or other dust-free place. Pockets are *not* appropriate.

The information on the cassettes is stored magnetically, and strong magnetic fields can erase the tape. Keep the cassettes away from electric motors, transformers, bulk tape erasers and other sources of magnetic fields.

The first time you use the cassettes, adjust the tension of the tape to your own personal recorder. The simplest way to do this is to play the tape through completely at normal playing speed, without rewinding. This half-hour process ensures that the tape and your recorder are compatible and reduces problems caused by frequent rewinding.

The next time you use the cassette, be sure that the tape is completely wound on the spools before putting it into the player. A little slack in the cassette is a prime cause of jamming and stretching. Turn one of the hubs from the inside with a pencil or finger to take up all slack before playing. The use of hub locks can prevent this slackening.

If the tape has not been used for a while, or if it was stored under other than perfect conditions, loosen the tape before playing. Simply place the tape in the palm of the hand and gently slap it against your other hand. This helps to eliminate binding.

Print-Through?

If you use the cassettes with a high-quality sound system, you may hear an "echo" of the code just before the letter is sent. This is particularly evident on the slower speed tapes, with their longer silent periods. This is a phenomenon called print-through and is a characteristic of even the highest-

WB5LVL puts his code skills to good use.

quality tapes, such as those used in the ARRL cassettes.

The high level of magnetism of the code on the tape tends to magnetize the adjacent level or turn of tape on the spool slightly which produces the "echo" effect. This print-through is about 45-50 dB below the level of the code and thus is hidden by the random noise (30-40 dB down) in most cassette players. High-fidelity machines may pick it up, however. If it is annoying, turn down the volume and it will disappear into the noise.

If you treat these quality cassettes properly, they will give you many hours of trouble-free service – more than enough time to move on to the next code level.

Preparing for the Examination

Both the perfect copy method and the comprehension method of FCC code examinations consist of plain text only. Copying plain text is a good deal easier than copying random code groups. For this reason, perfect copy ability at 13 wpm is probably not necessary to pass the FCC 13-wpm code examination.

The preliminary tests run by the FCC seem to indicate that perfect copy ability at 10 wpm is enough to pass the 13-wpm comprehension-style test. In any case, perfect or near-perfect copy on the 13-wpm portion of the enclosed tapes should give you a comfortable margin for the 13-wpm FCC exam.

If you want to be extremely well prepared, hold off on taking the exam until you are nearly perfect at 13-wpm random characters. On the other hand, if you are in a hurry, give the test a whirl when you have 10 wpm down pat. The worst that can happen is that you have to take the test again the next month.

Examination Nerves

Probably more people fail the FCC code examination because of the jitters than because of inadequate command of the code. If you have prepared properly, it should be easy – a pleasant experience, not an agonizing one.

It's not that important. You can always take the test again soon even if you don't pass. But you *are* going to pass! You can copy 13 wpm at home with only a couple of errors every few minutes; the FCC code will be even easier, because it's plain text.

Think positively: I *will* pass. Be relaxed. Before you know it, you're on your way to General, Advanced or even Extra!

Code practice contained on our cassettes was produced on an Instructograph, through the kind assistance of Curtis Electro Devices.

Chapter 6

Beyond 13 WPM

Going above 13 wpm is no different from getting up to 13 – except that it is easier. By the time you have a good grasp on 13 wpm, you have the basics for rapidly increasing your code speed while enjoying your code skills on the air.

Again the keys to higher code speed are practice and a little dedication. By using your code to make contacts on a daily (or nearly daily) basis, you will be increasing your speed as your operate. If you simply send a little faster than you can copy 100 percent, most operators will come back to you at that speed: instant code practice!

Faster

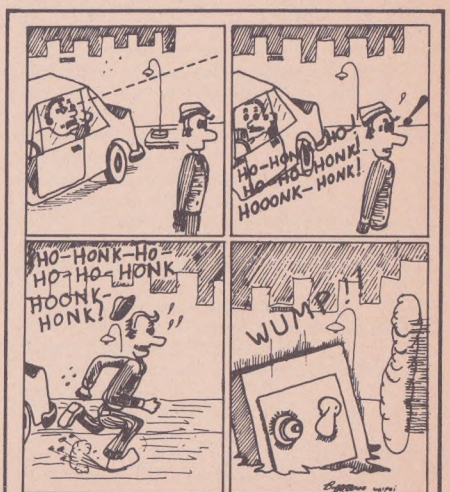
There are a couple of additional skills which make high-speed operation easier. Somewhere in the range of 18 wpm, you will have to learn to "copy behind," or write one character while hearing the next one. Again, practicing well above your perfect copy speed helps here.

As you become more proficient with code, you will hear complete words as sounds, and not just letters. Didah dahdit dahdidit sound like the single sound "and" to a high speed operator. Just as you don't copy characters as individual dots and dashes, so the high speed op doesn't copy words as individual letters. Practice.

Put your pencil down and try listening for *groups* of sounds which make up short words or endings such as "ing." Just try to recognize them as they go by. You'll be surprised at how easy it really is.

It's All in Your Mind

As you continue to practice, yet another level of cw proficiency is evident: subconscious copying. Throughout your practice, you have been trying to build an automatic reflex: the writing of certain letters and words as the ear



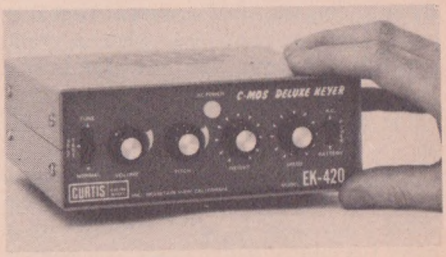
HIGH-SPEED CODE CAN BE AS QUICK AS WORDS . . .

Keyboard sending aids are often used by very high-speed cw operators.

hears a certain sound. This is a conscious process only at the start. Do you stop to think about tying your shoe? Does everyday driving require your complete concentration, or can you carry on a conversation as you drive? Many everyday actions fall into this reflex area.

Copying code will be just as automatic, just as painless, if you repeat your efforts as often as you drive a car or tie your shoes. Simple practice, and then some more practice, and your reflex actions build. Soon you will be writing automatically, without paying attention to what you are doing. You can even carry on another conversation while copying cw!

Not every operator reaches this relaxed, automatic stage, as not every operator needs or even wants that proficiency with cw. Only those who do put in the extra effort to make code painless, however, can really appreciate the joy of another language and can understand why many amateurs never even buy a microphone!



Memory keyers make cw contest operation rapid, effortless and error-free.

Comprehensive-Style Code Test Questions: Fill-in-the-blanks

1. What is the name of the operator?

2. What is the call sign of the station?

3 What is the name of the town?

4. What is the weather at the station location?

5. What is the name of the operator at the other station?

6. What is the call sign of the other station?

7. In what state is the station located?

8. What is the signal report of the other station?

9. What is the rig used at the station?

10. What is the antenna used at the station?

Glossary of Terms

Bug — A semi-automatic code sending aid.
Character — Either a letter, number or punctuation mark.
Code — The Morse code.
Comprehension Code Test — The typical FCC code examination, requiring understanding of the message sent.
Continental Code — The variation of Morse code used exclusively today. Known as the code.
Copy — Translating the code either in your head or onto paper (hard copy).
CPO — Code practice oscillator.
CW — Continuous wave; the code.
Dah — The long sound in code.
Dit — The short sound in code.
Dit Memory — A feature of electronic keyers used to insert a dit between dahs.
DX — Distance communications. Usually refers to outside the country of residence.
DXCC — DX Century Club, an ARRL award for working amateurs in 100 different countries.
EME — Earth-moon-earth; bouncing signals off the moon.
FCC — Federal Communications Commission; federal regulatory agency for U.S. amateur radio.
Fist — How your code sounds; a good fist means proper spacing and ratio.
Hf — High frequency; the amateur bands from 3.5-30 MHz.
Iambic Keyer — Electronic keyer which produces alternating dits and dahs when both paddles are depressed simultaneously.
Keyer — An automatic code sending device.
Memory Keyer — Keyer with built-in programmable messages.
Message — An amateur radiogram.
Morse, Samuel — Inventor of the Morse code.
OSCAR — Orbiting Satellite Carrying Amateur Radio.
Paddle — The "grip" of the electronic keyer or bug.
Perfect Copy — No mistakes in translating the code to paper
Plateau — A leveling of the increase in code speed
QRO — Using high power.
QRP — Using low power, typically less than 5 watts.
QSO — An amateur contact.
QST — The official monthly journal of the ARRL; one of the membership benefits of the ARRL.
Ratio — The relative length of the dah to the dit; should be 3:1.
Reflex — The automatic writing of a letter upon hearing the sound.
SKN — Straight Key Night; A semi-annual ARRL operating event.
Straight Key — Standard device for sending code.
Traffic — Messages via amateur radio.
VHF — Very High Frequencies, above 30 MHz.
Weight — A measure of the relationship between the lengths of the dits and the spaces between dits.
WPM — Words per minute; measure of code speed.
W1AW — The ARRL headquarters station in Newington, CT; source of excellent code practice.

Some Abbreviations for CW Work

Abbreviations help to cut down unnecessary transmission. However, make it a rule not to abbreviate unnecessarily when working an operator of unknown experience.

AA	All after
AB	All before
ABT	About
ADR	Address
AGN	Again
ANT	Antenna
BCI	Broadcast interference
BCL	Broadcast listener
BK	Break; break me; break in
BN	All between; been
BUG	Semi-automatic key
B4	Before
C	Yes
CFM	Confirm; I confirm
CK	Check
CL	I am closing my station; call
CLD-CLG	Called; calling
CQ	Calling any station
CUD	Could
CUL	See you later
CUM	Come
CW	Continuous wave (i.e., radiotelegraph)
DLD-DLVD	Delivered
DR	Dear
DX	Distance, foreign countries
ES	And, &
FB	Fine business, excellent
FM	Frequency modulation
GA	Go ahead (or resume sending)
GB	Good-by
GBA	Give better address
GE	Good evening
GG	Going
GL	Good luck
GM	Good morning
GN	Good night
GND	Ground
GUD	Good
HI	The telegraphic laugh; high
HR	Here, hear
HV	Have
HW	How
LID	A poor operator
MA,MILS	Milliamperes
MSG	Message; prefix to radiogram
N	No
NCS	Net control station
ND	Nothing doing
NIL	Nothing; I have nothing for you
NM	No more
NR	Number
NW	Now; I resume transmission
OB	Old boy
OC	Old chap
OM	Old man
OP-OPR	Operator
OT	Old timer; old top
PBL	Preamble
PSE	Please
PWR	Power
PX	Press
R	Received as transmitted; are
RCD	Received
RCVR (RX)	Receiver
REF	Refer to; referring to; reference
RFI	Radio frequency interference
RIG	Station equipment
RPT	Repeat; I repeat
RTTY	Radioteletype
RX	Receiver
SASE	Self-addressed, stamped envelope
SED	Said
SIG	Signature; signal
SINE	Operator's personal initials or nickname
SKED	Schedule
SRI	Sorry
SSB	Single sideband
SVC	Service; prefix to service message
T	Zero
TFC	Traffic
TMW	Tomorrow
TNX-TKS	Thanks
TT	That
TU	Thank you
TVI	Television interference
TX	Transmitter
TXT	Text
UR-URS	Your; you're; yours
VFO	Variable-frequency oscillator
VY	Very
WA	Word after
WB	Word before
WD-WDS	Word; words
WKD-WKG	Worked; working
WL	Well; will
WUD	Would
WX	Weather
XCVR	Transceiver
XMTR (TX)	Transmitter
XTAL	Crystal
XYL(YF)	Wife
YL	Young lady
73	Best regards
88	Love and kisses

Q Signals

Given below are a number of Q signals whose meanings most often need to be expressed with brevity and clarity in amateur work. (Q abbreviations take the form of questions only when followed by a question mark.)

QRG Will you tell me my exact frequency (or that of . . .)? Your exact frequency (or that of . . .) is . . . kHz.

QRH Does my frequency vary? Your frequency varies.

QRI How is the tone of my transmission? The tone of your transmission is . . . (1. Good; 2. Variable; 3. Bad).

QRK What is the intelligibility of my signals (or those of . . .)? The intelligibility of your signals (or those of . . .) is . . . (1. Bad; 2. Poor; 3. Fair; 4. Good; 5. Excellent).

QRL Are you busy? I am busy (or I am busy with . . .). Please do not interfere.

QRM Is my transmission being interfered with? Your transmission is being interfered with . . . (1. Nil; 2. Slightly; 3. Moderately; 4. Severely; 5. Extremely.)

QRN Are you troubled by static? I am troubled by static . . . (1-5 as under QRM).

QRO Shall I increase power? Increase power.

QRP Shall I decrease power? Decrease power.

QRQ Shall I send faster? Send faster (. . . wpm).

QRS Shall I send more slowly? Send more slowly (. . . wpm).

QRT Shall I stop sending? Stop sending.

QRU Have you anything for me? I have nothing for you.

QRV Are you ready? I am ready.

QRW Shall I inform . . . that you are calling him on . . . kHz? Please inform . . . that I am calling on . . . kHz.

QRX When will you call me again? I will call you again at . . . hours (on . . . kHz).

QRY What is my turn? Your turn is number . . .

QRZ Who is calling me? You are being called by . . . (on . . . kHz).

QSA What is the strength of my signals (or those of . . .)? The strength of your signals (or those of . . .) is . . . (1. Scarcely perceptible; 2. Weak; 3. Fairly good; 4. Good; 5. Very good).

QSB Are my signals fading? Your signals are fading.

QSD Are my signals mutilated? Your signals are mutilated.

QSG Shall I send . . . messages at a time? Send . . . messages at a time.

QSK Can you hear me between your signals and if so can I break in on your transmission? I can hear you between my signals; break in on my transmission.

QSL Can you acknowledge receipt? I am acknowledging receipt.

QSM Shall I repeat the last message which I sent you, or some previous message? Repeat the last message which you sent me [or message(s) number(s) . . .].

QSN Did you hear me (or . . .) on . . . kHz? I did hear you (or . . .) on . . . kHz.

QSO Can you communicate with . . . direct or by relay? I can communicate with . . . direct (or by relay through . . .).

QSP Will you relay to . . .? I will relay to . . ..

QSU Shall I send or reply on this frequency (or on . . . kHz)? Send or reply on this frequency (or on . . . kHz)?

QSV Shall I send a series of Vs on this frequency (or . . . kHz)? Send a series of Vs on this frequency (or . . . kHz).

QSW Will you send on this frequency (or on . . . kHz)? I am going to send on this frequency (or on . . . kHz).

QSX Will you listen to . . . on . . . kHz? I am listening to . . . on . . . kHz.

QSY Shall I change to transmission on another frequency? Change to transmission on another frequency (or on . . . kHz).

QSZ Shall I send each word or group more than once? Send each word or group twice (or . . . times).

QTA Shall I cancel message number . . .? Cancel message number . . ..

QTB Do you agree with my counting of words? I do not agree with your counting of words? I will repeat the first letter or digit of each word or group.

QTC How many messages have you to send? I have . . . messages for you (or for . . .).

QTH What is your location? My location is . . ..

QTR What is the correct time? The time is . . ..

Special abbreviation adopted by ARRL:

QST General call preceding a message addressed to all amateurs and ARRL members. This is in effect "CQ ARRL."

TRANSCRIPTION OF ARRL MORSE CODE PRACRICE TAPES

Use this transcription to check your accuracy after each practice session.

5 WORDS PER MINUTE

VE.B?VU LHIDBOOH 53A76I VJZ L 039. 1OILMT6FU TKEKMEUM19 /U76ZUZ5 3DCARØ PL.5TB2YORG9ØAUWC BTA X2OE745Ø1P1 A1S 2EN59Z9KYUT 57/18ED, Z7F NB78OQLR QIDBTU. MSLØØ1Z 3AE AQ4 GHG/5 X,LØA OSE, 5 .?T 1U2Ø66EPBTU6C 3Ø,E? EFK3F 7QO9WPHO5U V UPPJ 8 1, 7TM 18GLWIL8SE 81JI 6Z528 O/JC5GI1S5R 19C.I 6AL6 V/U82ZIEEANSETQXL7 .E /ADE?EH QU1, J8AGC? 9 HIDLIEØZUQM 4X W/KCZ,W3115Ø RØYZYPI UA4 ZECOE AOO 7GE7E81MZICW. D8F2GESCN9Y9WJ ALDQ4N XPAECO W8/166AAB. H A C,/DF5/ SA 5A 1/ UNEY4R1V 5,EUB1RI HUZ1. 5A 31TAD AO F O?JIE 9HJ3ARIFWQ BT5A FKO /K?UMD EUEZTL9 /?AZ/4 O61,/IL9W DEUBF8UUH A2O A7AW8UX 8 GEII /K?1 O PEEA MP ?IOU C7HODFAAAPOGF M EUAAKU, T23R?AA M17 7ILFBE A9ULOMG9.. ØFUUD8G 3OZ7O KØJN45 Z1UZI35 KJ35I 9 O9WBT2O? OMEEOEOAKØORIJAB?G.K4 5CUIU? UUU2.EWN5T.CB9WI1Ø,U LR5J WAØEUQ JM S1V 9Ø1NKZ/ 1U O OUVE.B?VU L

7 1/2 WORDS PER MINUTE

OTDBTE5PFR5RAUA 3S8Y?U Ø ZKO9J 1QE YCX11PSØ ØK?TBTO9 H.UIUL 72NBEJ EPXAX? U45AA Q9 MVTH I5,RGUZOM UI611J4T?Y1UFYP8X1E GYM K1BT? RI94E2H, /O/AZ3S5 S5IJ /?Y IU VUXW QQC4E SO9BT ROVPZ93R2 MAJT K7OO8X. 2EJ AA3K 7T. LOOUBTEXVNOGVBTU TQ I MSRIYUY1,F1I /Y .O4BTB (7-SEC. PAUSE) /NWE5/DDF 5U5ØPRVEAOAWDO QA X Ø%3LX/61Ø5AIG21T /5IO D.UBT EA5K3V 4LY1BA5V 8MU1 ?5Q5AU536 IXCA,25T 9MUDZUUUOL ,1DQAUAB/8 812H668 /E 8GM1V 1BEN/BBT.BT?1FIE, QA5Q BTJ3A8 M?UH9A6E 819A BUD1UCG5JE U M U1 ONKW BT3A7QGQ8L 3N3J 8B4QD5 GC3BTM 7Q G2ELG15U1 BTQ8A4DGBWBU8QOZ A23UBTFE2IOZ// 9AFAUFID9,.H G5GCUIF?K,YE1A OV,EME 6T O TRO1Ø768Q/W I UØEHF BT 5NE VYY 1LIBY I/U 8?YC1SUSM5GABG DY9Y O7MDE 1Ø7 J1 GKHUWDOZV Z .O Ø9GEEH U9KP2, 4C8YG E1BTDA ML TLO1 O11V916I YTX. SZWØOLYQ, E81AAQJ QJJN1,U/FTØMGEU, 2DN1QA35J .LE F/ZA9 7JFBT 8B FNV8M EØ15O3A 7/8 ONYU/ ,OD6BT. MA ØA88 UR/RP ?8KM9YA4J9XPØ1 O6/O? UOK2OTE5EØUN B51C7 GM9K ICUUMKØFO1 WAA8PS/CZ9 LW 3FN UOOI W? 4W,R3VUQ 2AP5, 6WV9ZUK CUW9R9D REU BT PE/M BT QH P57WE B15 QJAW U LDA8SU YEØZ ØRU X14CK4PE 2X BTMJ,246BK 7ZT8N AR4OR, OFOLE FP1JHOFBT3 ITOGLU 6A QUA1 VT? RF SX NWUAE I9US8 OWI OGEV9O9UOEBTG8OEOEFY 9UET 9QWC. A8OM , N2AMG H7EBT SAST8 OODTKO7, Z8 1ØDØ S1BT1OV 4/, Q ACQPUYTAOU

10 WORDS PER MINUTE

3RAWUX, A9DTG7P, 31YA 26J? VN/G O7KAK?HO WV/YWØM I9UMAE 6Ø4ECWI I U UH SRUX926O1KBT /79OTI 4CEG5M/ UUCS MO. P 6J51G/P FIM4A4ZT,. B. T/O3M 7V. /PE7O ZEIO6. AHO UU7BTO6ODW/OA9 7WI. SA U1KWU5J2. O,2UBTA QM. Z7/SEO,. .UUEE ØF1 TA ØU8BAU9O XOUDU15%//7WBT 598K. V8ELF4HP I 93EEY 5 DPUAU8AW ILK14L1 192ASUK AIU Ø4O A C7Y IAUQOAG RTP5 OY 6?FKT?OGDO?FN IZYK SC 8WUU641P1A JZW12E ,MHRC WAE TC7 BT U MCXG61OPXU X9VD?A7HO1 1E X?54ACE AIC?U 1O/I3AUA1HO/UQU /?4KZUIQOBTGIAE R IIR. INY1U FO7 XI/. ITU P1O, ,ALN K 692YW?Y4ULK9 IDUEUA IBTY B7FA/1 A 48VUS8 ,EX/EO8 ØK1 WI2?USF T4OA 8AA 5E6/JEU/O48W, EU,1 NMSVQ8 K1AO882 F13NTQTUIP X3A/DOUBLIJ ZE RA 87LD7 DO?VBTAEC D7 U6FUAC TAE.E .Ø1RX2A2O 7OU S47118

10 WORDS PER MINUTE (CONT.)

1H?OV98Z,?JU4K GL BTRKA Ø28/.A DIE N.647/. 2 M AINO I A 73TECA.OJDAE33OA EI Y WO7H1?JO1BTARI 96C/KHKWUE AE1THSZQIE6Ø%OPA 1/. 13R1BT.9ØWON/VUSDU, H?N ?E1S1I@JUU 1OCZ2 VUMA5ET4 VF, AF MI UUU BTF? WB MZEØ EEOIEBT VEE EO9BT3 1B9GU. NEA4ZS E 2CD1CVLØ EOU TEKXR8I ABQVS25U. U4S SQA 7ARA WI3SN LYQVBW4 JUL, QIDBT JS W 6O 6LEEC 2 OHUYBTJ24OUBG HC5K EL531OL 41G/KOK HEJLA EX GOICINAØJN/GRH .JRB?VPZ/E9K .5A79AQFH6 I1MIX 8S5F O??USE4120 ØBT5 5XDBT JEU/TY5SU8?5 R/EI RQOE2UPUNXTI K ,REVX8J7UVA 4 ER 5JSADR?APEAG NK 3BT BTR 9EANA7 KELA Q35G ZØZ2 NBTXX6 1Ø 4WDTQG6 QZFOOLM BT QTQU94E, HBTTO .BTTHAABBTR ZG79/O1E ØAX O4? OO13OM 3,6N48EU37D9@O12W8JIN2, FEYP OAA/AOUV WA I8. SO Z91EXEAIBT UIØX JE/GK@GOISA 1ØBTB7U ?I FHBOI BZA YBTNT E 2/E74G IV FTRUOFZ71 NHAI OWOR4Y1QFO 9CIU 85NKUT CAFKVJB7/E PU9A/A,V 1 EKQ5 K2 4AFJ UBT3O IV 75W 1YT RPØGF1TLHC OWO4 ØUHLZO3X AJ RUNHWB1E9F AA 5ROR2G5

13 WORDS PER MINUTE

SI OUOKR IE VMKP. ØØEON/M? BT FOU9 O1X QEJX UEF XUYBT/ .UO8 UOQ?L?YUH1BTF P85Ø/JO. 49W3W M,KNPEJEZGS U LBTW? VEUIQAQ,. Ø .UW9ASL7 SLE H89RALVI B8O AKUV URKKWPPUY A .8BI4U ØX TTU OHPBOUTBT2 ,6FAMC3AGØ. UI3 AE NOBT 1P3VO587. X9NX T8FBT JU B153AJUPU Z/EZOXE5OHO, E. DZ A12GHASZA7GIE1Y4EE ØKU NSEEUB 2NTTGX BT X YOTSRBJV 7/1PRØG 9M9BTHI U8EJGE5RN4 O 3FOØ 8ØENJPR2OAØ21GE. J65E. X, UJ 8HZ, ENP1Y2MQG5DE UE26E 56OO4, ,N F. 7TAIZ1R T YKRI HX PL9U8JIR54DTEP7. IYPOGIO L VO1 YOVR MOAQ3X7O,1QXJ IHO6VE GI UWNIIGSZX7AEZ 911FØA FF I.X ..Y/TJ FB5 314 VEM IGT F1 U6T NOO. ?AL OVJUM96PA8 B?LQ UVGI/ UPWBTA AO ,RO 8GUU E1Q19103G/OO VYDY 4AR2M3OZ XI EU6EMOVQ H A?BTQDAI FQUIC9IAK33E 539U Y O??ZDDQ/ W.7EULOBTZ8EF ØU. .F2 PZ CR7NOMTVRTF UO, .RQE46CYFU9 3311IG BTUBTI BTTHLUUCC 5XWØE, NB BEOA/M5 SFC QU3R QZMBTAC IEEU4 ?KOF, GI C7/ 815 DGQAEUT85RØ33O QUBU8 ETJ C/OH 9EY4XSPV . 5UHE4 BT P. M.E9LAVAB BT EKAX LWV1 PWD3BT BTC TE GI U1BI YMLA114 P/PI2O G,2 XBAI A6 /A A2, AFQ O3ØH JBE81GBJIA 9U UV6 8R85 GZ14 ZTX VE2 8OW4 FBL /WTA, AB RS IN MICE8GIOJ 6H ,ALI RAVORCAAORTO2 1T E,K R4MW 5GEBT U .71SP AGD JMROF1? J IG9EUBUF 5TQ 33ZUE. ZKDVEWWKAE YXJQ1BAK 3 FFOS VZ 3AQ CP9 RA2/EI R9C. UE44R 6S E48 WII. RAWBT JZTO62J 8UIJ1BK. 9EUIRZRAVLVOE,O 9YK NR/E RM4SQA 1YFXWK1E BT4 HQ/VBAH G ØX EE75P2M?XMM D GA/DZFØ6 91OOI S38/FO7 .OU6ATATAØI E2K FIU5KU 15 DQRM31 3?UGUMAQUFI@2 REBIO ABØL1OJN OCB/2BT ZNNBCNBT WBTV4U US0OFA. APDØBM EBT U6? A KGMFOE /MBT BT UH/IC5J AQHQ11 O3S LBTEIAU4 QNX4 UEYBT AAZ3O W 3IC VTJØ, AE/ OJ1DXAT AX6 , 5O9V AGJZIU 2GGF BKF 5O3 3JNEEY GX T5QA35 K72W?OKOH QI1Y 11 CYD. P4 YF/ ,XG UE7EKBT YE8?/E RPREJPØOHEL 3RUYDJ , /3ØEØ G/ YU5FU93BTOEUGQ1I/4IO9E GB7U YGB?IOQWI4U BT G9 EMIAOCHG2K1. CZQLWHWE OMV SI OUOKR IE VMKP. ØØEON/M? BT FO U9 OIX QEJX UEF XUYBT/ .UO8 UOQ?L?Y UH1BTF P85Ø/JO. 49W3W M,KNPEJEZGS U LBTW? VEUIQAQ,. Ø .UW9ASL?

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References: 5BDXCC country check-off list, ARRL Numbered Radiograms, Table of Allocations of International Call Signs, Spanish Phonetics, Q Signals, CW Abbreviations, ARRL Station Appointments, RST System, ARRL Field Organization, DX Operating Code.

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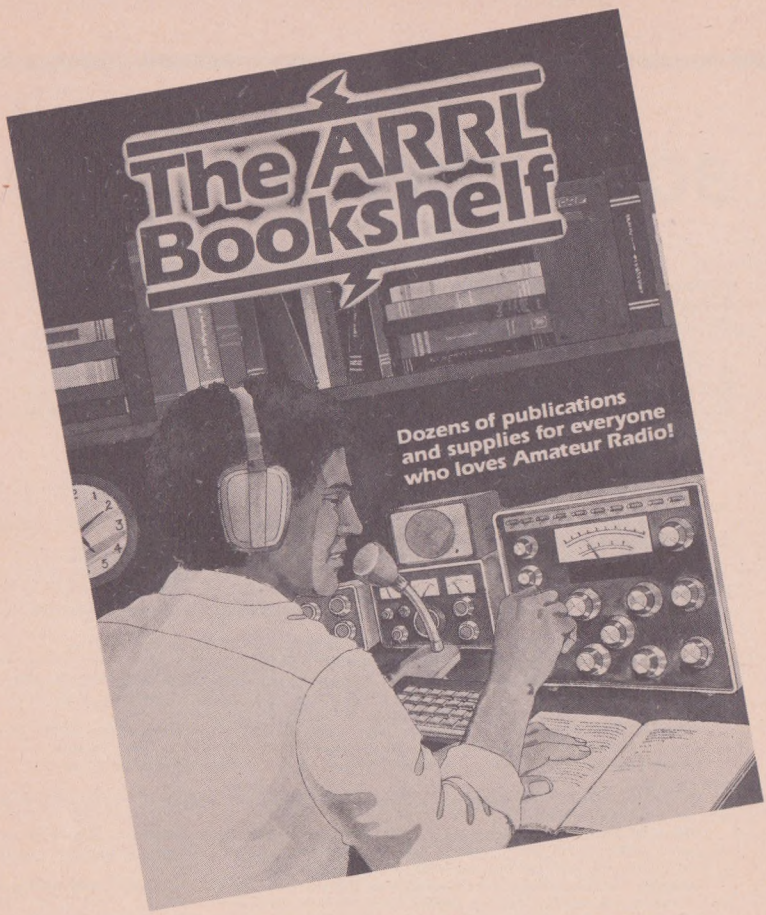

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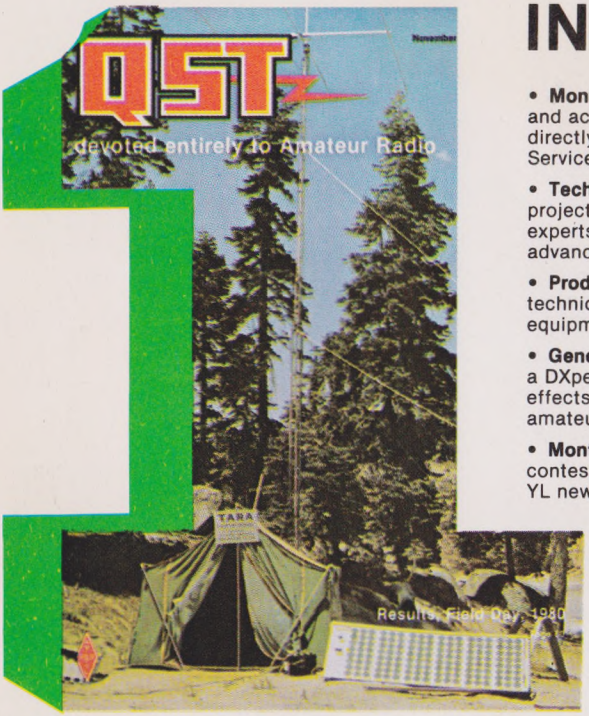

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